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Mapping Mars‘ northern plains: origins, evolution and response to climate change – a new overview of recent ice-related landforms in Acidalia Planitia.

Ernst Hauber (1), Csilla Orgel (1,2), Stephan van Gasselt (2), Dennis Reiss (3), Andreas Johnsson (4), Jason Ramsdale (5), Matthew Balme (5), Susan Conway (5), Francois Costard (6), Colman Gallagher (7), Akos Kereszturi (8), Thomas Platz (2), Antoine Séjourné (6), James Skinner (9), Zuzanna Swirad (10), and Anna Łosiak (11)

(1) Institut für Planetenforschung, DLR, Berlin, Germany (Ernst.Hauber@dlr.de), (2) Institut für Geologische Wissenschaften, FU Berlin, Germany, (3) Institut für Planetologie, WWU Münster, Germany, (4) Univ. Gothenburg, Sweden, (5) Dept. Physical Sciences, Open University, Milton Keynes, UK, (6) Université Paris Sud, Orsay, France, (7) University College Dublin, Ireland, (8) Eötvös Loránd University, Budapest, Hungary, (9) USGS Flagstaff, USA, (10) Durham University, UK, (11) Instytut Nauk Geologicznych PAN, Wrocław, Poland

An International Space Science Institute (ISSI) team project has been convened to study the northern plains of Mars. It uses a geomorphological grid-mapping approach to compare ice-related landforms across N-S traverses in the three main basins of the northern plains: Acidalia, Arcadia, and Utopia Planitiae. The main science questions are (i) the distribution of ice-related landforms in the northern plains and their relation to distinct latitude bands or different geological units, (ii) the relationship between the latitude dependent mantle (LDM) and landforms indicative of ground ice, and (iii) the distributions and associations of recent landforms indicative of thaw of ice or snow.

We mapped individual landforms across the Acidalia Planitia that may have been formed in association with ice or water in an attempt to determine their extent and identify possible spatial relationships and genetic links between them. Our list includes mantling deposits, small-scale polygons, gullies, viscous flow features, thumbprint terrain (TPT), giant polygons and large pitted mounds (LPM). Our resulting maps show the distribution of specific landforms (no data – absence – presence – dominance) in grid cells with a size of ∼20 × 20 km, but allows also for some ambiguity (possible).

Preliminary results show that the mantling deposits are ubiquitous and occur basically everywhere between ∼43°N and almost the margin of the north polar cap. As their surface may appear smooth if intact, their texture can be difficult to detect at CTX scale. Gullies were observed within a limited latitude range between ∼32°N and ∼54°N. They predominantly occur in Acidalia and Acidalia Colles, although gullies were found in several impact craters. Small-scale polygons occur between ∼60°N to ∼70°N in agreement with previous studies. They are predominantly oriented in orthogonal networks in crater interiors, depressions and on plains. Viscous flow features are present only in higher-relief areas of the Acidalia Mensae and Colles. Their morphology is not well pronounced, partially subdued and covered, and most features are restricted to debris aprons distributed circumferentially around small knobs. TPT appears north of about 30°N in the most distal parts of the Chryse outflow channels and shows a transition zone with LPM at around 36°N and it is not observed north of ∼39N°. The giant polygons with the LPM have been considered analogous to fluid expulsion features in terrestrial sedimentary basins. They characterize the study area from to 35 N° until 61 N° and completely disappear in the Acidalia Colles region.

Grid mapping proved to be an efficient way to map small-scale landforms over wide areas. The distribution of possible ice- and water-related features in Acidalia is clearly latitude- and topography-dependent